Energy System Integration

Public Interest Energy Research Program
California Energy Commission

Distributed Energy Resources
and
Demand Response
RD&D Plan Briefing

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Today's Briefing

- PIER Mission
- DER Integration RD&D Overview
- DER C&C Activities
- DR RD&D Overview
- DR C&C Activities

PIER RD&D Mission

- Conduct public interest research to improve quality of life by providing environmentally sound, safe, reliable and affordable energy services and products
- Includes RD&D to advance science and technology not adequately provided by competitive and regulated markets

DER Integration Research Focus

- Systems-level and enabling RD&D in the areas of interconnection, grid effects and market integration
- Not a commercialization program

Research Objectives

- Near-Term (<5 years)
  - Enable safe interconnection to grid
  - Determine limits of DER penetration into grid
  - Quantify and demonstrate grid benefits
  - Demonstrate novel approach of microgrids
- Mid-Term (5-10 years)
  - Optimize benefits/impacts of DER
  - Determine and enable market mechanisms to capture and monetize DER benefits

Promising RD&D in the Pipeline

Currently funding $2.5M in DER RD&D

- Alternative Energy Systems Consulting (AESC) - Advanced Communication & Control Technology
- Consortium for Electric Reliability Technology Solutions (CERTs) - Microgrid Concept
- FOCUS - Simplified Interconnection (Rule 21) and Case Studies

New Projects

~$5M in DER RD&D activities planned this year

- Within 6 months
  - DUIT Testing (~$2.0M)
  - Microgrids Testing (Preparation $980k w/ test $ TBD)
  - Interconnection Guidebook ($62k)
  - National Interconnection Standards Support ($74k)
- Within 6 - 12 months
  - Regional Solutions Pilot ($TBD)
  - DOE Communication & Control Standards ($TBD)
- Identifying next year's projects and budget

DER C&C Needs

- Extensive assessment of RD&D needs for interconnection, grid effects and market integration
- Assessed gaps for comm & control strategies pursued

Little or No Gaps

- Demo aggregation and control of DER

Moderate Gaps

- Advanced control and optimization approaches (e.g., neural networks and intelligent software agents)
- Low cost communication and controls

Significant Gaps

- Standards and protocols for comm/control (e.g., national standards)

DER C&C Priorities

Several observations can be made from assessment

- Numerous proprietary products exist for aggregating DER
- DOE, NYSERDA, SCAQMD and private sector developing lower cost communications and controls
- DOE and CEC developing advanced concepts such as neural networks and intelligent software agents
- Need for national standards as most significant

Therefore, greatest need for collaboration is focusing on national standards development

DR RD&D Overview

- Program just getting underway
- Two projects will commence this summer
  - Baseline demonstrations and case studies
  - Enabling technology development
- Both are sole source but may have tasks in which others can participate
- Both have significant C&C components and challenges

Baseline Studies

- Will attempt to establish how much real-time "automated" DR potential there is in large commercial buildings and institutional facilities that have been outfitted with state-of-the-art communications, control, and management/monitoring software
- Project will be managed by LBNL
- Project Manager, Mary Ann Piette
- Near term, 1-2 years

Enabling Technology Development

- Will attempt to develop DR enabling C&C and other technologies that can reduce installed costs by an order of magnitude
- Medium-term (3-5 years) and long-term (5-8 years) objectives
- Project will leverage CITRIS research already underway at UC Berkeley

CITRIS

- Center for Information Technology Research in the Interest of Society
- http://www.citris.berkeley.edu/
- CITRIS initial research includes energy efficiency, transportation, seismic safety, education, health care, and environmental monitoring.
- Build on Funding from DARPA, private sources
- All our research results in the public domain

CITRIS Technology Projects

- Smart dust ("motes")
- PicoRadio
- MEMS sensors
- Self-organizing networks (TinyOS)
- Energy scavenging
- Technology integration
- Building and other energy applications

CITRIS Energy Program

- Initial Focus on Smart Buildings
  - High-density sensor networks will allow existing environmental control technologies to operate in more sophisticated and energy-efficient ways, and the redundancy of sensors will improve the reliability of control by detecting faulty signals.
  - High-density sensor networks will also allow new energy-efficient environmental control technologies to become feasible for the first time.
- Three phases
  - Phase 1: Passive monitoring
  - Phase 2: Develop Mechanisms for Monitoring and Control
  - Phase 3: Active Energy Management through Feedback/Control
- Extensions to Distribution and Generation Possible

DR C&C Activities

- A large part of the DR enabling technology development project is expected to directly relate to DER C&C objectives/requirements
  - reference designs for a variety of control, communications, and monitoring platforms
  - architectures for utilizing overlapping public and private networks
- Research will include evaluating new topologies & boundaries for layered control

DER & DR Summary

- Research results will be shared through workshops, papers, electronic media, etc.
- Collaboration with DOE on DER C&C initiatives will be evaluated
- DR enabling technology development is expected to evolve over time and have application to other energy agendas including DER

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